

CLAIMS

1. A three-dimensional image display device comprising:
a two-dimensional image display screen having color
5 filters in which each color is disposed on sub-pixels
obtained by dividing one pixel in a vertical direction and
same color is disposed on each column of sub-pixels;
an optical plate having an exit pupil, the exit pupil
being provided for making a viewing zone different for each
10 pixel and having a longitudinal axis disposed as to be
inclined from a vertical direction of the two-dimensional
image display screen at a degree (θ) ($\theta \neq 0$, $-45^\circ < \theta < 45^\circ$),
the viewing zone being a region in which parallax
information displayed on the two-dimensional image display
15 screen is observed; and
a viewing zone adjusting unit that adjusts the viewing
zone by shifting the viewing zone in a horizontal direction
of the two-dimensional image display screen by shifting the
parallax information disposed on each pixel of the two-
20 dimensional image display screen in the vertical direction
by pixel.
2. The three-dimensional image display device according
to claim 1, wherein the viewing zone adjusting unit shifts
25 the viewing zone in the horizontal direction by further
shifting the parallax information in the horizontal
direction by pixel.
3. The three-dimensional image display device according
30 to claim 2, further comprising:
a shift direction determining unit that determines
whether to shift the parallax information in the vertical
direction or the horizontal direction, according to a shift

amount of the viewing zone to be shifted by the viewing zone adjusting unit, wherein

the viewing zone adjusting unit shifts the parallax information in the shift direction by the number of pixels
5 according to the shift amount.

4. The three-dimensional image display device according to claim 1, wherein

the longitudinal axis of the exit pupil of the optical
10 plate is disposed in a direction inclined from the vertical direction of the two-dimensional image display screen at a degree $(-45^\circ < \theta < 0^\circ)$, and

the viewing zone adjusting unit shifts the parallax information from top to bottom in the vertical direction by
15 pixel, when shifting the viewing zone from a right side to a left side when viewed from an observer side in the horizontal direction of the two-dimensional image display screen.

20 5. The three-dimensional image display device according to claim 1, wherein

the optical plate is disposed in a direction inclined from the vertical direction of the two-dimensional image display screen at a degree $(-45^\circ < \theta < 0^\circ)$, and

25 the viewing zone adjusting unit shifts the parallax information from bottom to top in the vertical direction by pixel, when shifting the viewing zone from a left side to a right side when viewed from an observer side in the horizontal direction of the two-dimensional image display
30 screen.

6. The three-dimensional image display device according to claim 1, wherein

the optical plate is disposed in a direction inclined from the vertical direction of the two-dimensional image display screen by a degree ($0^\circ < \theta < 45^\circ$), and

the viewing zone adjusting unit shifts the parallax information from bottom to top in the vertical direction by pixel, when shifting the viewing zone from a right side to a left side when viewed from an observer side in the horizontal direction of the two-dimensional image display screen.

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7. The three-dimensional image display device according to claim 1, wherein

the optical plate is disposed in a direction inclined from the vertical direction of the two-dimensional image display screen at a degree ($0^\circ < \theta < 45^\circ$), and

the viewing zone adjusting unit shifts the parallax information from top to bottom in the vertical direction by pixel, when shifting the viewing zone from a left side to a right side when viewed from an observer side in the horizontal direction of the two-dimensional image display screen.

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8. The three-dimensional image display device according to claim 1, further comprising:

an viewing position displacement detecting unit that detects an viewing position displacement amount which is a displacement amount between an viewing position on which a three-dimensional image displayed on the three-dimensional image display device should be observed and an actual position of an observer; and

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an viewing zone shift amount determining unit that determines a shift amount of the viewing zone based on the viewing position displacement amount, wherein

the viewing zone adjusting unit shifts the viewing zone by the shift amount.

9. The three-dimensional image display device according to claim 8, further comprising:

the viewing position holding unit that holds the viewing position, wherein

the viewing position displacement detecting unit recognizes a position of the observer by image recognition, and detects a difference value between the recognized position of the observer and the viewing position held by the viewing position holding unit as the viewing position displacement amount.

10. The three-dimensional image display device according to claim 8, wherein

the viewing position displacement detecting unit detects the viewing position displacement amount in the horizontal direction of the two-dimensional image display screen, and

the viewing zone shift amount determining unit determines the shift amount of the viewing zone based on the viewing position displacement amount in the horizontal direction.

11. The three-dimensional image displaying device according to claim 8, wherein

the viewing position displacement detecting unit detects the viewing position displacement amount in the vertical direction of the two-dimensional image display screen, and

the viewing zone shift amount determining unit determines the shift amount of the viewing zone based on

the viewing position displacement amount in the vertical direction.

12. The three-dimensional image display device according to claim 8, further comprising:

an inclination detecting unit that detects an inclination of the two-dimensional image display screen; and

a viewing zone shift amount determining unit that determines the shift amount of the viewing zone based on the inclination, wherein

the viewing zone adjusting unit shifts the viewing zone by the shift amount.

13. The three-dimensional image display device according to claim 1, further comprising:

an optical plate position displacement amount obtaining unit that obtains from outside an optical plate position displacement amount which is a displacement amount between the two-dimensional image display screen and the optical plate; and

a viewing zone shift amount determining unit that determines the shift amount of the viewing zone based on the optical plate position displacement amount, wherein

the viewing zone adjusting unit shifts the viewing zone by the viewing zone shift amount.

14. The three-dimensional image display device according to claim 1, further comprising a surplus portion processing unit that disposes the parallax information on a pixel, which is located on the two-dimensional display screen and on which the parallax information is not disposed after the shift of the parallax information.

15. The three-dimensional image display device according to claim 1, further comprising a surplus portion processing unit that disposes a black image on a pixel, which is
5 located on the two-dimensional display screen and on which the parallax information is not disposed after the shift of the parallax information.

16. The three-dimensional image display device according to claim 1, further comprising:
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a parallax information holding unit that holds the parallax information, a size of which is larger than a size of the two-dimensional image display screen, wherein

the two-dimensional image display screen displays the
15 parallax information held by the parallax information holding unit.

17. The three-dimensional image display device according to claim 16, further comprising

20 a parallax information preparing unit that prepares the parallax information, the size of which is larger than the size of the two-dimensional image display screen, wherein

the parallax information holding unit holds the
25 parallax information prepared by the parallax information preparing unit.

18. A method of displaying a three-dimensional image comprising:

30 in a three-dimensional image display device including a two-dimensional image display screen having color filters in which each color is disposed on sub-pixels obtained by dividing one pixel in a vertical direction and

same color is disposed on each column of sub-pixels, and
an optical plate having an exit pupil, the exit
pupil being provided for making a viewing zone different
for each pixel and having a longitudinal axis disposed as
5 to be inclined from a vertical direction of the two-
dimensional image display screen at a degree (θ) ($\theta \neq 0$, -
 $45^\circ < \theta < 45^\circ$), the viewing zone being a region in which
parallax information displayed on the two-dimensional image
display screen is observed,

10 shifting the viewing zone in a horizontal direction of
the two-dimensional image display screen by shifting the
parallax information disposed on each pixel of the two-
dimensional image display screen in the vertical direction
by pixel.

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19. A computer program product having a computer readable
medium including programmed instructions, wherein the
instructions, when executed by a computer, cause the
computer to perform:

20 in a three-dimensional image display device including
a two-dimensional image display screen having
color filters in which each color is disposed on sub-pixels
obtained by dividing one pixel in a vertical direction and
same color is disposed on each column of sub-pixels, and
25 an optical plate having an exit pupil, the exit
pupil being provided for making a viewing zone different
for each pixel and having a longitudinal axis disposed as
to be inclined from a vertical direction of the two-
dimensional image display screen at a degree (θ) ($\theta \neq 0$, -
30 $45^\circ < \theta < 45^\circ$), the viewing zone being a region in which
parallax information displayed on the two-dimensional image
display screen is observed,

shifting the viewing zone in a horizontal direction of the two-dimensional image display screen by shifting the parallax information disposed on each pixel of the two-dimensional image display screen in the vertical direction by pixel.

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